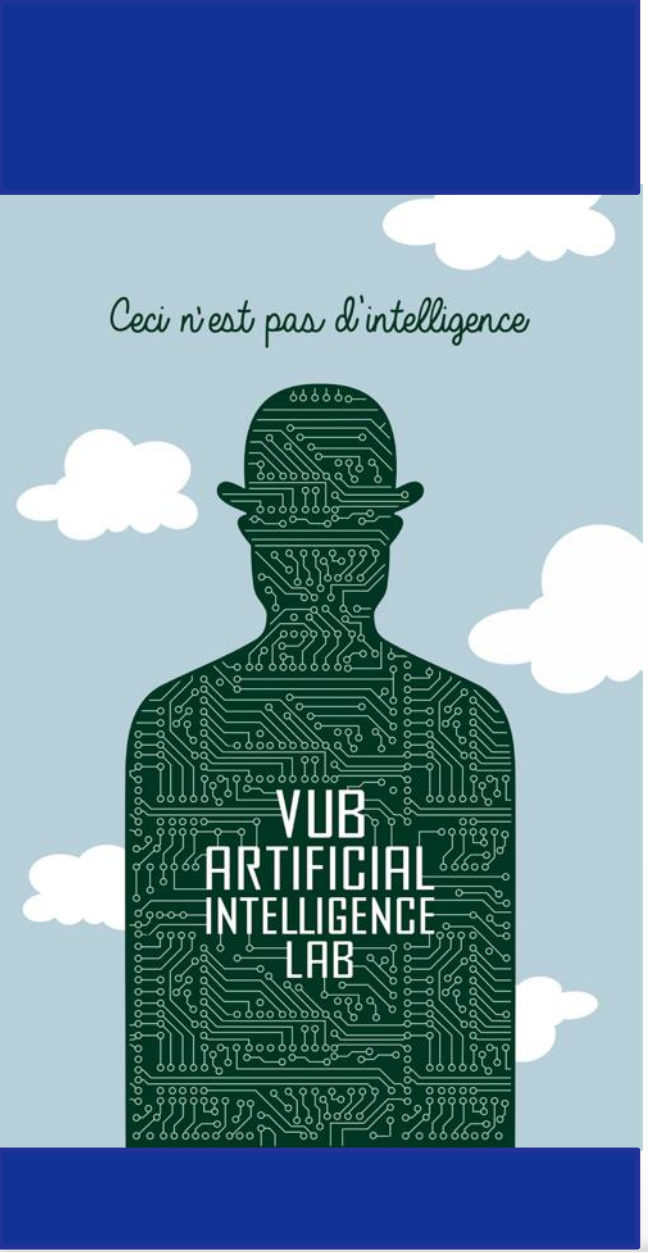

Artificial Intelligence Lab

Gill Balcaen – Business Developer

AI & Smart Grids

for cost minimisation and optimal efficiency

ai.vub.ac.be

@aibrussels

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AI Lab – 1. The team

Strong heritage

Founded in 1983
by Prof. Luc Steels

First AI lab on the European mainland

37 years of experience

1000+ publications
30 000+ citations

Great team

50 researchers
from 22 countries
13 professors

- Founder of **'computational creativity'** research field
- **Ringleader** Flanders AI research Program
- **Prestigious grant holders**: ERC, NWO Vidi, …
- Multiple links with **MIT**
- Founders of **Collibra**, **Sony** computer Science lab Paris, …

AI Lab – 2. Our focus

Reinforcement learning

Multi-agent systems

Knowledge **representation** and **reasoning**

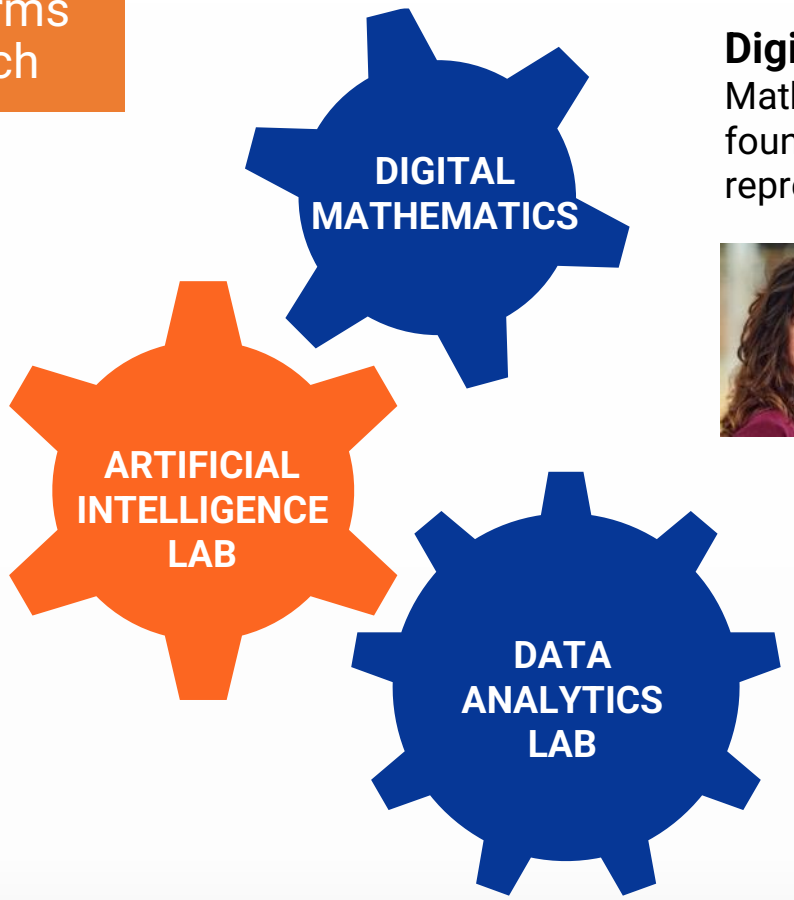
Computational **creativity**

Hybrid AI

Emergent **Communication**

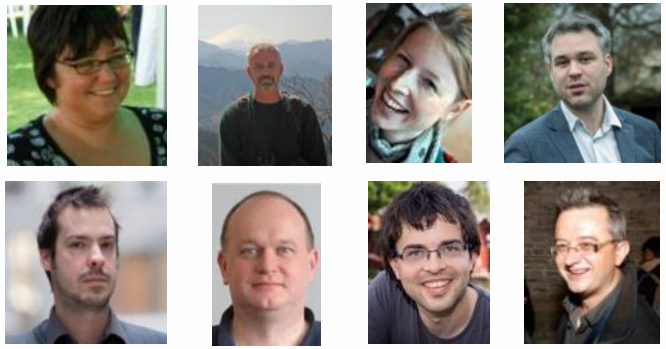
AI lab Consortium – 3. The Network

Interdisciplinary team that performs **fundamental** and **applied** research



Digital Mathematics
Mathematical aspects of data science foundations for data acquisition, representation and analysis

Artificial Intelligence Lab
Symbolic and subsymbolic AI, Agnostic and cognitive AI



Data Analytics Lab
Applied data science, business-oriented

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3. The network – Brubotics

Economics

Human Physiology

Life Sciences

Marketing

Rehabilitation Research

Social Studies

Robotics

Social Sciences

Engineering

SMIT

brubotics

Ageing studies

Industrial Engineers

Over 120 researchers...

E-Health

Artificial Intelligence

Electronics & Informatics

Computer Sciences (AI)

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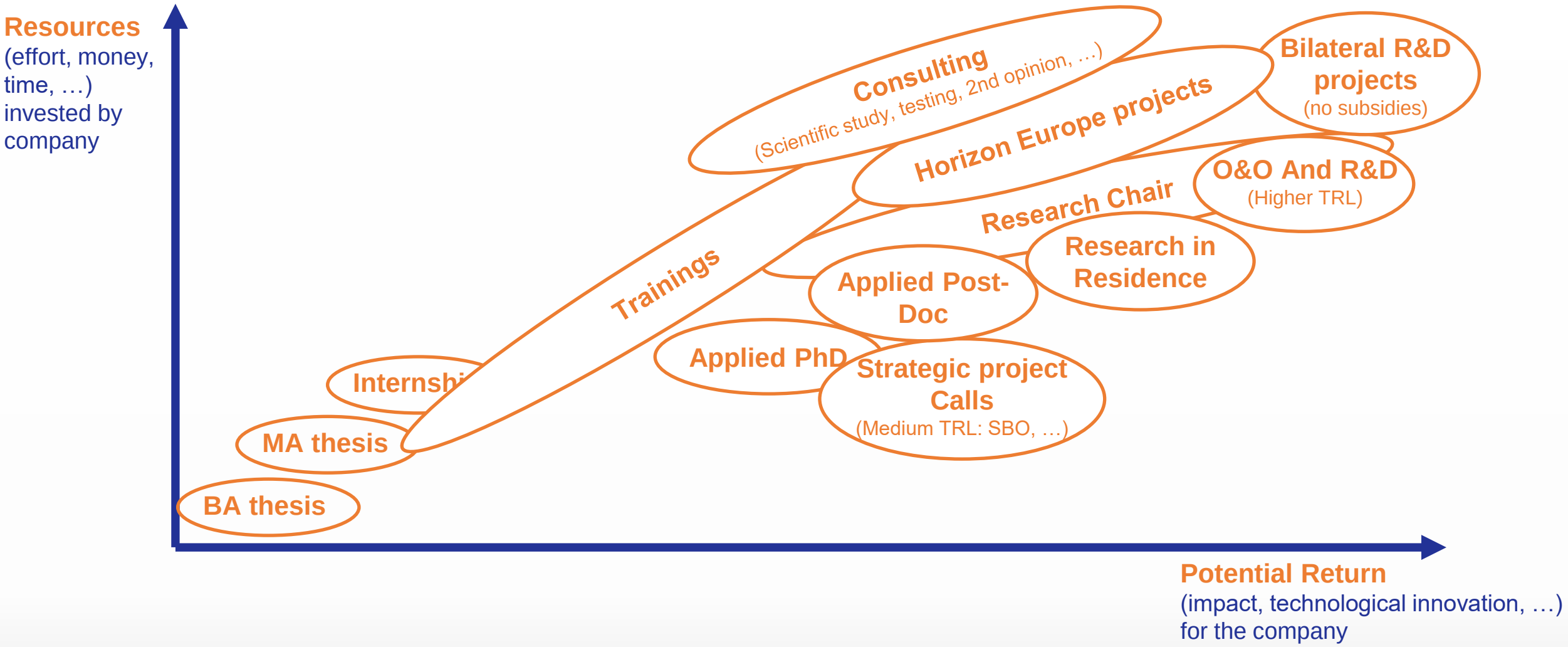
VUB ETRO ELECTRONICS & INFORMATICS

How do we collaborate?

How we collaborate with companies



Which industries are we active in?

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Examples

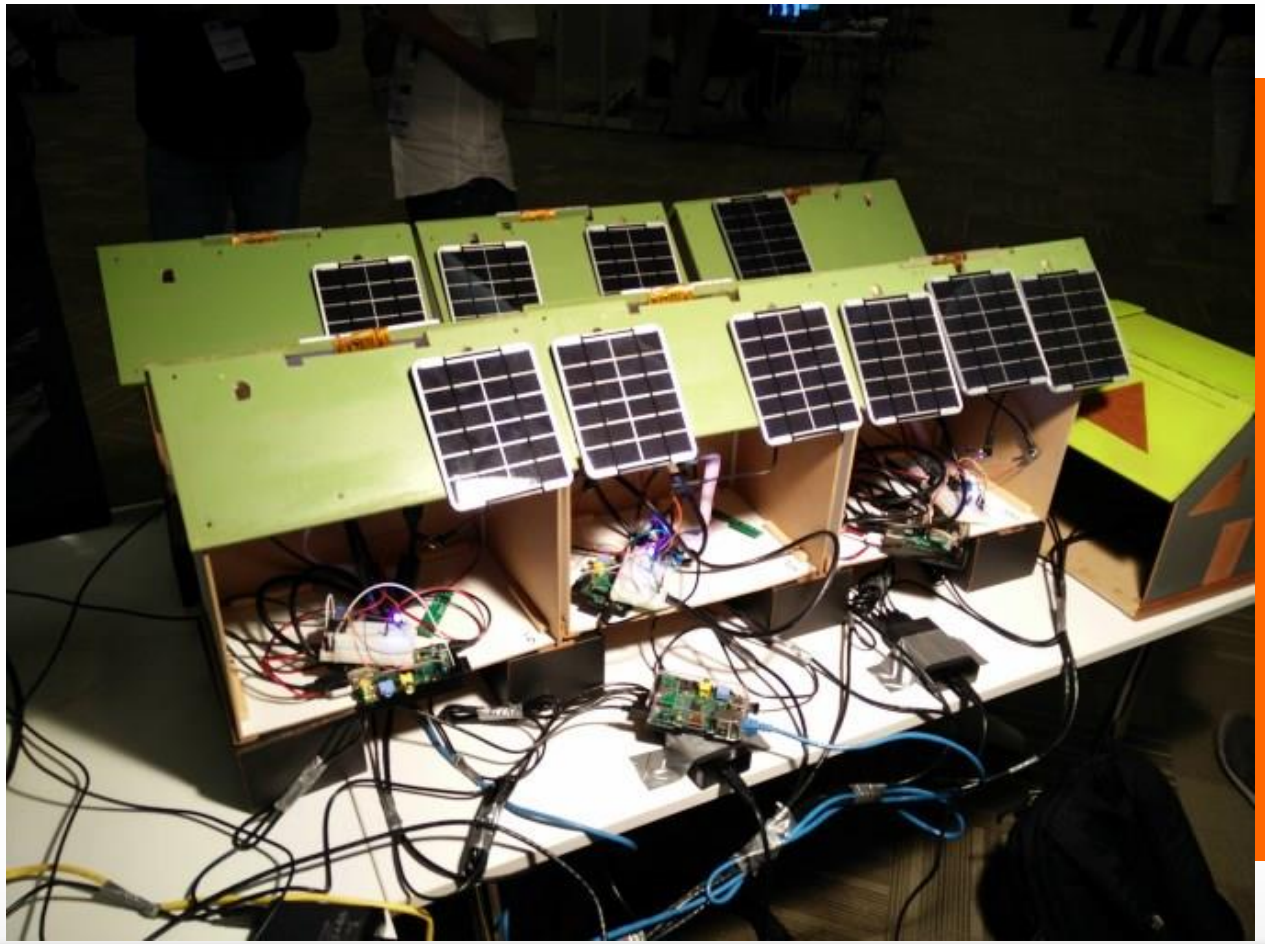
Examples – Smart grids

Properties of multi-agent systems

- Multi-agent systems need to:
  - **adapt rapidly** to unpredictably changing environments
  - **adhere to constraints, rules and regulations**, even in the absence of central control
  - **be accountable and manageable** by their creators
  - **interact with humans**, by understanding their intentions and explaining their own behavior
  - **be open-ended**, so new agents users and technologies can join at any time

Agents in a smart grid model

NRGcoin



- **Blockchain & smart contracts**
- Rewarding use of green energy
- Multi agent system

Examples – predictive maintenance

Windfarm control

Take into account

- Overall **weather** conditions
- Energy **demand**
- Current **health conditions** of the turbines in the farm

Result: less downtime, less costs and more reliable energy output

Examples – Planning

Reinforcement learning to optimize charging of electric vehicles

Scheduling algorithm for charging of EVs (electric vehicles)

Challenges

- **Constraints** (# charging connectors, maximum load of the grid, minimize charging time, maximize battery lifetime, minimize charging cost, etc.)
- **Uncertainties** (arrival and departure of EV, amount of energy needed to charge battery, available green energy, etc.)

Solution

- **Dynamic** algorithm needed
- Reinforcement learning learns the optimal scheduling through a simulator, taking into account **changing and implicit behavior** and **external factors** such as weather, traffic, etc.

Examples – Other

Recipe recommender

In Brief:

Recommender system for new (pastry) Recipes

In detail

- **Suggest ingredients** (and quantities) and baking **process** (temperature, time, technique, …)
- Aims for **intended characteristics** (texture, flavour, nutritional value, …) and other **requirements** (cost, shelf life, …)
- + Discovery: try new recipes (vs cost of trying)

Smart Heating

In Brief:

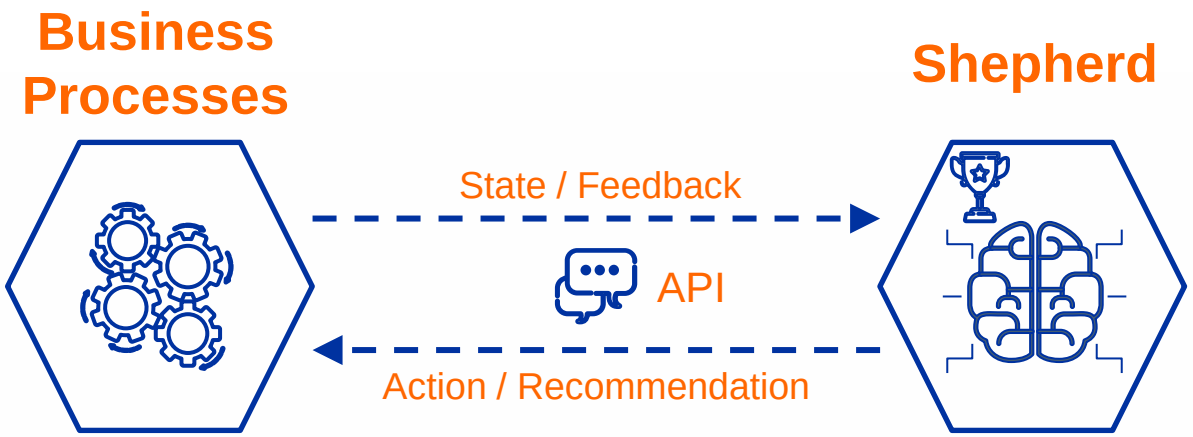
- **Personalized** Heating system
- For **trade-off between thermal comfort and energy savings**

Subcomponents

1. Automatic user profile & prediction
2. Schedule morphing to optimize personalized trade-off
3. Dynamic user profiles
4. Multiple user environments
5. Control strategy

Shepherd

State of the art reinforcement learning made available through an API



In Brief:

- **SotA RL** algorithms
- **Run, maintain & keep up to date**: VUB
- Accessible through **Web API**

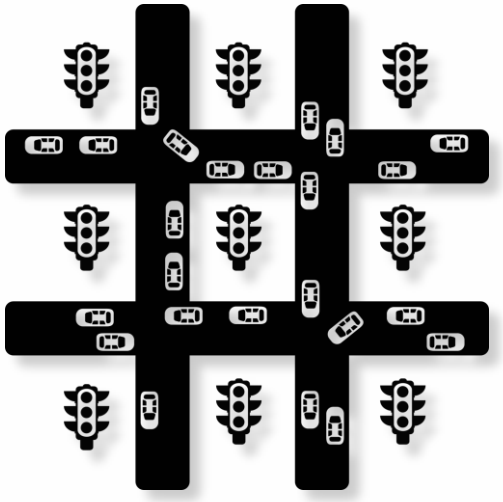
➔ Try out best in class on your use case before investing

Service: AI expert

- **Formalizing** business problem as RL problem
- **Support with setup** & interaction from Business side
- When successful: possibility to pull in on **your premisses**

Reinforcement learning for congestion minimisation

Smart traffic lights



- Goal: improve traffic flow
- Traffic is dynamic: decision of one traffic light may affect traffic elsewhere
- Our approach: divide-and-conquer (solve problem for local neighborhoods and then combine solutions)

Smart tolling system

- Drivers are self-interested: they choose routes that minimise their travel cost (regardless of others)
- We devised a distributed, virtual tolling system that enforces drives towards the social optimum
- Guaranteed to minimise congestions

Networks and partners

End

Training Offer

INSPIRE YOUR STAFF

INSPIRATIONAL LECTURE

Create a positive vibe and make your staff enthusiastic about AI. Ideally accompanied by a visit to the AI Experience Centre.

Your **go-to before anything else**.

TAKE AWAY FEAR

DEMYSTIFICATION COURSE

Interactive session to demystify AI for technical and non-technical teams. We explain in-depth what AI is, and why you should care.

Great sessions to **take away fear**.

EXPLORE YOUR POTENTIAL

OPPORTUNITY WORKSHOP

We will **map out the potential of AI for you** ordered in a 4-quadrant map according your readiness and position compared to the competition.

Discover **where to start**.

MANAGE YOUR RISK

IMPACT ASSESSMENT

AI can lead to unexpected and unwanted results, and is coming under increasing scrutiny from legislators. We will identify your **risks**, along with **measures & recommendations**.

Be **prepared for the unexpected**.

KNOW YOUR POSITION

READINESS ASSESSMENT

In this workshop we will determine how ready your organisation is to start with AI. We will make a detailed assessment on 5 axes: capabilities, technology, data, vision and culture.

Pass this **gate before implementing**!

UPSKILL YOUR STAFF

TRAINING & COACHING

Once you decide to dive into implementation, we can support you with deep technical advice and state-of-the-art, brought by a team of >50 PhD researchers and AI professors.

À la carte **scientific support**.

Contact us

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We continuously investigate how we can help companies become **more innovative** and **increase their excellence** through the potential of AI.

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